



**US Army Corps
of Engineers®**
New York District

NEW YORK AND NEW JERSEY HARBOR DEEPENING CHANNEL IMPROVEMENTS

NAVIGATION STUDY

DRAFT INTEGRATED FEASIBILITY REPORT & ENVIRONMENTAL ASSESSMENT

APPENDIX B4:

Cost Engineering

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1. Introduction

The enclosed cost engineering analysis corresponds with deepening the major shipping channels of the NY/NJ Harbor for the two pathways studied to an authorized depth of -54FT and -55FT MLLW. The two pathways include the larger “Sea to Elizabeth-Port Authority Marine Terminal (EPAMT) Pathway” and the smaller “Mid-Anchorage to Port Jersey-Port Authority Marine Terminal (PJPAMT) Pathway”.

The cost engineering process for this study relies heavily on the experience of the New York District’s completion of its most recent harbor expansion projects. Since 2016, the harbor has welcomed some of largest ocean-going vessels calling East Coast American ports. This study examines prospects for a next phase to further deepen, straighten and widen the harbor’s channels using the same methods that were employed during that earlier phase.

In addition to appropriate consideration of and reference to cost and schedule information available from this prior phase of harbor expansion, the cost engineering involved in this study also incorporates important insights into the changed terrain of the harbor bottom as a result of this previous expansion. The widespread use of drilling and blasting the hardest of the harbor’s rock-bottom channels targeting its current 50FT federally authorized depth, allows for some efficiencies and cost savings in the next phase. Specifically, it is expected that significant quantities of consolidated rock that were previously too competent to be dredged without pretreatment will be found ready for excavation, already fractured during the previous phase.

The Total First Cost for the 54FT alternative and the 55FT alternative are presented in Table 1 and Table 2 on page 4 and 5 respectively.

Table 1: First Costs Table 54FT Alternative

NY/NJ HARBOR DEEPENING & CHANNEL IMPROVEMENTS STUDY (54FT ALT)							
October 2020 Price Level							
Feasibility Report Cost Estimate Summary							
Feat. Acct.	Description	Qty	UoM	Subtotal	Cont. %	Cont \$\$	Total Cost
01	LANDS AND DAMAGES	1	LS	\$503,000	20.0%	\$101,000	\$604,000
02	RELOCATIONS	1	LS	\$242,000,000	35.4%	\$85,710,000	\$327,710,000
06	FISH& WILDLIFE FACILITIES	1	LS	\$14,400,000	11.4%	\$1,639,000	\$16,039,000
12	NAVIGATION PORTS & HARBORS	1	LS	\$2,333,086,000	30.8%	\$719,489,000	\$3,052,575,000
18	CULTURAL RESOURCE PRESERVATION	1	LS	\$2,820,000	8.6%	\$242,000	\$3,062,000
30	PLANNING, ENGINEERING AND DESIGN	1	LS	\$272,192,000	10.9%	\$29,691,000	\$301,883,000
31	CONSTRUCTION MANAGEMENT	1	LS	\$97,211,000	11.2%	\$10,905,000	\$108,116,000
	TOTAL			\$2,962,212,000	28.6%	\$847,777,000	\$3,809,989,000

Table 2: First Costs Table 55FT Alternative

NY/NJ HARBOR DEEPENING & CHANNEL IMPROVEMENTS STUDY (55FT ALT)							
October 2020 Price Level							
Feasibility Report Cost Estimate Summary							
Feat. Acct.	Description	Qty	UoM	Subtotal	Cont. %	Cont \$\$	Total Cost
01	LANDS AND DAMAGES	1	LS	\$851,000	20.0%	\$170,000	\$1,021,000
02	RELOCATIONS	1	LS	\$242,000,000	35.4%	\$85,710,000	\$327,710,000
06	FISH& WILDLIFE FACILITIES	1	LS	\$14,700,000	11.4%	\$1,674,000	\$16,374,000
12	NAVIGATION PORTS & HARBORS	1	LS	\$2,500,959,000	30.8%	\$766,656,000	\$3,267,615,000
18	CULTURAL RESOURCE PRESERVATION	1	LS	\$2,820,000	8.6%	\$242,000	\$3,062,000
30	PLANNING, ENGINEERING AND DESIGN	1	LS	\$289,850,000	10.9%	\$31,579,000	\$321,429,000
31	CONSTRUCTION MANAGEMENT	1	LS	\$103,518,000	11.2%	\$11,597,000	\$115,115,000
	TOTAL			\$3,154,698,000	28.5%	\$897,628,000	\$4,052,326,000

2. Basis of Costs

2.1. Navigation Ports & Harbors

The basis of the majority of the cost estimate for the recommended plan rests with the work associated with the excavation and removal of material to deepen, widen and straighten the

shipping channels that make up the pathways to EPAMT and PJPAMT. These construction activities involve dredging, hauling and placement of nearly 34 million cubic yards of material from the channels that make up these pathways to get to a federally authorized 54FT channel and about 40 million cubic yards to authorize the channel to 55FT.

This material to be removed includes recent sedimentation, much of which is expected to be non-HARS-suitable and to require upland placement and processing. Other sediment to be removed from the designed channel template is expected to be suitable for HARS placement and the remaining material is expected to be consolidated rock or till of various types. Some of the rock is expected to require pretreatment before excavation will be feasible and this cost estimate assumes that all required pretreatment will be accomplished with the assistance of drilling and blasting techniques commonly employed by major contractors of the American dredging industry.

2.1.1. Drilling & Blasting

Based on the experience of the previous phase of deepening the harbor and available geotechnical information, it is anticipated that approximately 20% of the volume to be removed from the Sea to EPAMT pathway will require pretreatment before successful excavation with commonly available dredging equipment and techniques. None of the Mid-Anchorage to PJPAMT pathway is expected to require such pretreatment.

This study and the costs contained assume that the required pretreatment is to be accomplished by the same barge-based drilling and blasting techniques that were employed by more than one contractor during the previous phase of deepening. Other techniques for pre-treating hard rock may be available to industry, but are not widely enough used to match the Army Corps Cost Community of Practice's standards for what can be reasonably expected of an average contractor.

An important consideration within this study has been the lasting effects of the blasting performed during the previous phase of channel deepening. In particular, much of the harder rock to be removed in any future deepening projects has already been fractured by the drilling and blasting process. For this reason, it is assumed that 30-40% of the area to be deepened that contains rock that would, in its natural state, require pretreatment, will be clearable to grade without any drilling and blasting.

Drilling and blasting cost and schedule estimates were assembled based on offshore crewing, material, production and equipment assumptions consistent with the practices of the dredging industry, including the local restrictions on night-time and Sunday blasting.

Due to the proximity of the proposed blasting activities to developed population centers, a five-sensor vibration monitoring program will follow the blasting activities to facilitate the measurement and assessment of potential damages. These vibration monitoring costs are captured within the drilling and blasting portion of this estimate.

2.1.2. Dredging and Placement

The study's tentatively selected plan involves expansion of the harbor's major shipping channels from the Sea to EPAMT and PJPAMT pathways to an authorized depth of -54FT or -55FT, MLLW. The primary means for accomplishing such an expansion involves the dredging and removal of many millions of cubic yards of sedimentary and consolidated earth from the bottoms of the channels.

To deepen both pathways to -54FT, MLLW, it is estimated that 33.7M CY of material will require removal by dredging. To deepen to -55FT, MLLW, an estimated 40.2M CY of material will need to be removed. These estimates include paid overdepth dredging, which are standard to the industry, necessary for the efficiency of contracted dredging services.

Based on the available geotechnical information, the study finds that the total volume of anticipated material will breakdown into approximately 25% HARS-suitable non-consolidated sediment, 35% non-HARS-suitable sediment to be dredged and delivered to an upland processing facility and 40% consolidated material or glacial till to be pre-treated where necessary (see "Drilling and Blasting" section) and dredged and placed either at the HARS or at offshore artificial reef sites.

This cost estimate assumes that all HARS-suitable sediment will be dredged and hauled to the HARS by Trailing Suction Hopper Dredges and that all remaining dredging will be completed by mechanical dredges, with material to be hauled either upland to the processing facilities or offshore to the reef sites in scows propelled by appropriate tugboats.

This estimate also assumes that the dredging of non-HARS-suitable sediment will require the extra precautions and costs which are traditionally involved in handling such materials

All dredging estimates are produced with the Corps of Engineers Dredge Estimating Program and all drilling and blasting estimates are based on the NY District's labor, materials and equipment estimating tool for such operations. Production and cost assumptions are applied based on typical and reasonable performance of the work by a well-equipped dredging contractor.

2.1.3. Table 3: Depths and Estimated Required Quantities

(Does not include overdepth volumes which is captured in the costs)

	Proposed Maintained Channel Level [ft MLLW]	Proposed Authorized Channel Level [ft MLLW]	Total Depth [ft MLLW]	Quantity to be Dredged (cy)	Proposed Maintained Channel Level [ft MLLW]	Proposed Authorized Channel Level ^a [ft MLLW]	Total Depth [ft MLLW]	Quantity to be Dredged (cy)
	4 FOOT DEEPENING TO -54 FEET MLLW				5 FOOT DEEPENING TO -55 FEET MLLW			
Ambrose Channel	57	57	58	4,137,000	58	58	59	6,389,000
Anchorage Channel	54	54	55.5	2,551,000	55	55	56.5	3,800,000
Port Jersey Channel	54	56 ^c	57.5	2,744,000	55	57 ^c	58.5	3,003,000
Kill Van Kull	54	56 ^c	57.5	3,237,000	55	57 ^c	58.5	4,451,000
Newark Bay	54	56 ^c	57.5	13,181,000	55	57 ^c	58.5	14,148,000
South Elizabeth Channel	54	56 ^c	57.5	379,000	55	57 ^c	58.5	423,000
Port Elizabeth Channel	54	56 ^c	57.5	855,000	55	57 ^c	58.5	1,024,000
Total Quantity Dredged	--	--		27,084,000	--	--		33,238,000

Maintained channel level includes the summer saltwater draft, squat, salinity, wave motion, and safety clearance. The channels will be maintained at this depth. The authorized channel level includes additional safety clearance needed for hard bottom. The total depth includes an additional dredging tolerance (paid overdepth). This is the sum of the depths and specific to each plan.

2.1.4. Specialty Demolition

In addition to the material excavation covered by the preceding blasting and dredging discussions, approximately 15,000 cubic yards of adjacent structures are estimated to require removal as part of this project. This volume includes potential removals of piers and bulkheads adjacent to the proposed channel alignments.

2.1.5. Operations & Maintenance

Consistent with the estimated schedules and durations presented in section 3, construction completion for the 54FT and 55FT alternatives are estimated for 2039 and 2041, respectively. 50 years of maintenance dredging is assumed.

The anticipated volume of additional maintenance dredging for each channel is calculated based on the estimated rate of sedimentation observed from past operation and maintenance of the harbor applied to any portions of the channel to be widened as part of this project.

Consistent with current New York District practice, the Port Jersey channel is anticipated to be maintained by dredging every 10 years, the Anchorage channel reaches to be maintained every 7 years and all other channels are assumed to be maintained every 3 years. Table 4 presents the estimated increased in annual sedimentation for maintenance dredging.

Table 4: Estimated Increase in Annual Sedimentation for Maintenance Dredging

Channel	Estimated Increase in Annual Sedimentation (CY)
Anchorage	5,318
Kill Van Kull	3,781
Port Jersey	7,409
Newark Bay	86,658
South Elizabeth	540

2.2. Lands & Damages

Cost estimates for real estate activities associated with the recommended plan were provided by the Real Estate specialists and appraisers of the PDT. Real Estate costs include all anticipated government labor, such as for property appraisers and attorneys, demolition and disposal of impacted private properties and estimated business impacts or required relocations (separate from utility relocations).

2.3. Relocations

Utility relocation costs are estimated parametrically with reference to past USACE experience with horizontal drilling technology. Several utility relocations will be required as part of the proposed changes to the harbor channels. Estimated costs for removal and replacement of existing utilities vary based on dimensions and accessibility.

2.4. Environmental and Cultural Mitigation

Costs associated with environmental mitigation (Fish & Wildlife Facilities, WBS Account 06) and cultural mitigation (Cultural Resource Preservation, Account 18) were provided by biologists and archaeologists from the study PDT. See the appropriate appendices for discussion of these costs.

2.5. Planning, Engineering and Design

The cost was developed for all activities associated with the planning, engineering and design effort. The cost for this account includes the preparation of Design Documentation Reports, plans, and specifications for the New York and New Jersey Harbor Deepening Channel Improvements, and engineering support during construction through project completion. It includes all the in-house labor based upon work-hour requirements, material and facility costs, travel, and overhead.

2.6. Construction Management

The cost was developed for all construction management activities from pre-award requirements through final contract closeout. This cost includes the in-house labor based upon work-hour requirements, materials, facility costs, support contracts, travel and overhead. The cost was developed based on the input from the construction division in accordance with the Civil Works Breakdown Structure (CWBS) and includes, but is not limited to, anticipated items such as the salaries of the resident engineer and staff, surveyors, inspectors, drafters, clerical, and custodial personnel; operation, maintenance and fixed charges for transportation and for other field equipment; field supplies; construction management, general construction supervision; and project office administration, distributive cost of area office and general overhead charged to the project.

2.7. Berth Deepening Costs

Similar to Interest During Construction, the estimated costs of deepening the port's berths is a necessary consideration in the overall cost benefit analysis but is not part of the estimated total project cost. For the purpose of its appropriate consideration, these berth deepening costs are estimated based on the volumes provided applied to the average dredging costs (including upland placement and blasting where applicable) of the adjacent channel reach as estimated for the Navigation Ports and Harbors.

3. Construction Schedule

All scenarios assume that construction activities will start in the year 2025. This date also corresponds with the anticipated Midpoint of Design for all contracts for anticipated construction activities. It is assumed that all other required activities, such as utility relocations, any real estate acquisitions and mitigation activities will take place concurrent with the assumed critical path, previously discussed. It is estimated that the duration of all construction activities for deepening the harbor to an authorized depth of 54FT will require 14.5 years to complete. For deepening to 55FT, 16 years will be required, as shown in Figures 1 and 2 in Section 7 of this appendix.

3.1. Interest During Construction

Interest during construction (IDC) is the amount of interest the construction cost would earn were it invested from the beginning of construction until the accumulation of benefits begins. IDC cost has been added to the project cost to determine investment cost. Average annual cost was determined based on investment cost, which includes IDC. The pre-base year costs were estimated using the Federal interest rate of 2.50 percent (FY21). The annual costs include the annualized investment cost along with annual operation and maintenance cost. A detailed breakdown of annual costs for the 54 FT alternative and the 54 FT alternative is presented in Table 5 and 6..

Table 5: Annualized Costs Table 54FT Alternative

NY/NJ HARBOR DEEPENING & CHANNEL IMPROVEMENTS STUDY (4FT ALT)			
Annualized Cost Summary			
First Cost			\$ 3,809,989,000
Sunk Cost			\$ -
Investment Cost			
Sponsor costs (berth deepening)			\$ 168,865,000
Interest During Construction ^(a)			\$ 572,717,000
		Total Investment Cost:	\$ 4,551,571,000
Annual Costs			
Annualized Investment Cost ^(b)			\$ 160,480,000
Annualized Operation & Maintenance Repair, Replacement & Rehabilitation Cost			\$ 8,213,000
Total Annual Cost*			\$ 168,693,000
*October 2020 Price Level (Program Year 2021)			
(a) Based on construction duration @ 2.50% (IDC, E&D, RE and Sunk costs calculated separately and included in this total)			
(b) Annualized investment cost only includes the remaining features. For annualized investment cost with the sunk cost, please see the economic appendix. $i = 2.50\%$ and $n = 50$ yrs			

Table 6: Annualized Costs Table 55FT Alternative

NY/NJ HARBOR DEEPENING & CHANNEL IMPROVEMENTS STUDY (5FT ALT)			
Annualized Cost Summary			
First Cost			\$ 4,052,326,000
Sunk Cost			\$ -
Investment Cost			
Sponsor costs (berth deepening)			\$ 182,799,000
Interest During Construction ^(a)			\$ 669,123,000
		Total Investment Cost:	\$ 4,904,248,000
Annual Costs			
Annualized Investment Cost ^(b)			\$ 172,914,000
Annualized Operation & Maintenance Repair, Replacement & Rehabilitation Cost			\$ 7,782,000
Total Annual Cost*			\$ 180,696,000
*October 2020 Price Level (Program Year 2021)			
(a) Based on construction duration @ 2.50% (IDC, E&D, RE and Sunk costs calculated separately and included in this total)			
(b) Annualized investment cost only includes the remaining features. For annualized investment cost with the sunk cost, please see the economic appendix. $i = 2.50\%$ and $n = 50$ yrs			

4. Contingencies

As stated in ER 1110-2-1302, the goal in contingency development is to identify the uncertainty associated with an item of work or task, forecast the cost/risk relationship, and assign a value to this task that would limit the cost risk to an acceptable degree of confidence. Consideration must be given to the details available at each stage of planning, design, or construction for which a cost estimate is being prepared. Contingencies may vary throughout the cost estimate and could constitute significant portion of the overall costs when the lack of investigated data or design details are available. Final contingency development and assignment that describes the potential for cost growth is included in the cost estimate. During development of the cost estimates, sufficient contingencies developed via PDT discussions during Abbreviated Risk Analysis (ARA) were applied to develop the Total Project First Cost. The breakdown of items within each account. The contingency factors used in the two alternatives are summarized in Tables 7 and 8 on page 14.

4.1.1. Table 7 – 54FT Authorized Depths Contingency Factors

Element	Contingency Factor
Relocations	35.42%
Fish and Wildlife Facilities	11.38%
Navigation, Ports and Harbors	30.65%
Cultural Resource Preservation	8.75%
Total Construction Contingency	31.13%
Lands & Damages	20.00%
Planning, Engineering, and Design	10.89%
Construction Management	11.20%

4.1.2. Table 8 – 55FT Authorized Depths Contingency Factors

Element	Contingency Factor
Relocations	35.42%
Fish and Wildlife Facilities	11.38%
Navigation, Ports and Harbors	30.65%
Cultural Resource Preservation	8.75%
Total Construction Contingency	30.95%
Lands & Damages	20.00%
Planning, Engineering, and Design	10.89%
Construction Management	11.20%

5. Total Project Cost Summaries

The fully funded cost for the -54FT and the -55 MLLW are \$4,869,958,000 and \$5,181,753,000 respectively.

5.1. Total Project Cost Summary: Sea to EPAMT & PJPAMT Pathways (Authorized to -54FT, MLLW)

PROJECT: HDCI Feas. Study TSP: Sea to Port Elizabeth & Port Jersey (54FT Authorized Depth)
 PROJECT NO: 472473
 LOCATION: NY/NJ Harbor

DISTRICT: NAN
 POC: ACTING CHIEF, COST ENGINEERING, Cynthia Zhang
 PREPARED: 10/22/2020

This Estimate reflects the scope and schedule in report; Feasibility Study

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)					TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	Program Year (Budget EC): Effective Price Level Date: 2021 1 OCT 20				Spent Thru: 1-Oct-20 (\$K)	TOTAL FIRST COST (\$K) K	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
						ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J						
02	RELOCATIONS	\$242,000	\$85,710	35.4%	\$327,710	0.0%	\$242,000	\$85,710	\$327,710	\$0	\$327,710	19.7%	\$289,581	\$102,562	\$392,143
06	FISH & WILDLIFE FACILITIES	\$14,400	\$1,639	11.4%	\$16,039	0.0%	\$14,400	\$1,639	\$16,039	\$0	\$16,039	19.7%	\$17,231	\$1,961	\$19,192
12	NAVIGATION PORTS & HARBORS	\$2,333,086	\$719,489	30.8%	\$3,052,575	0.0%	\$2,333,086	\$719,489	\$3,052,575	\$0	\$3,052,575	29.4%	\$3,019,672	\$931,221	\$3,950,893
18	CULTURAL RESOURCE PRESERVATION	\$2,820	\$242	8.6%	\$3,062	0.0%	\$2,820	\$242	\$3,062	\$0	\$3,062	19.7%	\$3,374	\$289	\$3,663
CONSTRUCTION ESTIMATE TOTALS:		\$2,592,306	\$807,079		\$3,399,386	0.0%	\$2,592,306	\$807,079	\$3,399,386	\$0	\$3,399,386	28.4%	\$3,329,858	\$1,036,034	\$4,365,892
01	LANDS AND DAMAGES	\$503	\$101	20.0%	\$604	0.0%	\$503	\$101	\$604	\$0	\$604	15.4%	\$581	\$116	\$697
30	PLANNING, ENGINEERING & DESIGN	\$272,192	\$29,691	10.9%	\$301,883	0.0%	\$272,192	\$29,691	\$301,883	\$0	\$301,883	18.6%	\$322,876	\$35,220	\$358,096
31	CONSTRUCTION MANAGEMENT	\$97,211	\$10,905	11.2%	\$108,116	0.0%	\$97,211	\$10,905	\$108,116	\$0	\$108,116	34.4%	\$130,621	\$14,653	\$145,273
PROJECT COST TOTALS:		\$2,962,213	\$847,776	28.6%	\$3,809,989		\$2,962,213	\$847,776	\$3,809,989	\$0	\$3,809,989	27.8%	\$3,783,936	\$1,086,022	\$4,869,958

ACTING CHIEF, COST ENGINEERING, Cynthia Zhang

ESTIMATED TOTAL PROJECT COST: **\$4,869,958**

PROJECT MANAGER, Mark Lulka

CHIEF, REAL ESTATE, Lydia Willian

CHIEF, PLANNING, Cliff Jones

CHIEF, ENGINEERING, Michael Rovi

CHIEF, OPERATIONS, Thomas Creamer

CHIEF, CONSTRUCTION, Matthew Ludwig

CHIEF, CONTRACTING, Francis Cashman

CHIEF, DPM, Joseph Seebode

**** CONTRACT COST SUMMARY ****

PROJECT: HDCI Feas. Study TSP: Sea to Port Elizabeth & Port Jersey (54FT Authorized Depth)
 LOCATION: NY/NJ Harbor
 This Estimate reflects the scope and schedule in report; Feasibility Study

DISTRICT: NAN PREPARED: 10/22/2020
 POC: ACTING CHIEF, COST ENGINEERING, Cynthia Zhang

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 20-Aug-20		Effective Price Level: 1-Oct-20		Program Year (Budget EC): 2021		Effective Price Level Date: 1 OCT 20						
		RISK BASED												
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)	ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	PHASE 1 or CONTRACT 1													
02	RELOCATIONS	\$242,000	\$85,710	35.4%	\$327,710	0.0%	\$242,000	\$85,710	\$327,710	2027Q2	19.7%	\$289,581	\$102,562	\$392,143
06	FISH & WILDLIFE FACILITIES	\$14,400	\$1,639	11.4%	\$16,039	0.0%	\$14,400	\$1,639	\$16,039	2027Q2	19.7%	\$17,231	\$1,961	\$19,192
12	NAVIGATION PORTS & HARBORS	\$2,333,086	\$719,489	30.8%	\$3,052,575	0.0%	\$2,333,086	\$719,489	\$3,052,575	2030Q1	29.4%	\$3,019,672	\$931,221	\$3,950,893
18	CULTURAL RESOURCE PRESERVATION	\$2,820	\$242	8.6%	\$3,062	0.0%	\$2,820	\$242	\$3,062	2027Q2	19.7%	\$3,374	\$289	\$3,663
	CONSTRUCTION ESTIMATE TOTALS:	\$2,592,306	\$807,079	31.1%	\$3,399,386		\$2,592,306	\$807,079	\$3,399,386			\$3,329,858	\$1,036,034	\$4,365,892
01	LANDS AND DAMAGES	\$503	\$101	20.0%	\$604	0.0%	\$503	\$101	\$604	2026Q1	15.4%	\$581	\$116	\$697
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	\$25,923.06	\$2,828	10.9%	\$28,751	0.0%	\$25,923	\$2,828	\$28,751	2025Q1	16.0%	\$30,070	\$3,280	\$33,350
0.5%	Planning & Environmental Compliance	\$12,962	\$1,414	10.9%	\$14,375	0.0%	\$12,962	\$1,414	\$14,375	2025Q1	16.0%	\$15,035	\$1,640	\$16,675
5.0%	Engineering & Design	\$129,615	\$14,139	10.9%	\$143,754	0.0%	\$129,615	\$14,139	\$143,754	2025Q1	16.0%	\$150,349	\$16,400	\$166,749
0.5%	Reviews, ATRs, IEPRs, VE	\$12,962	\$1,414	10.9%	\$14,375	0.0%	\$12,962	\$1,414	\$14,375	2025Q1	16.0%	\$15,035	\$1,640	\$16,675
0.5%	Life Cycle Updates (cost, schedule, risks)	\$12,962	\$1,414	10.9%	\$14,375	0.0%	\$12,962	\$1,414	\$14,375	2025Q1	16.0%	\$15,035	\$1,640	\$16,675
0.5%	Contracting & Reprographics	\$12,962	\$1,414	10.9%	\$14,375	0.0%	\$12,962	\$1,414	\$14,375	2025Q1	16.0%	\$15,035	\$1,640	\$16,675
1.0%	Engineering During Construction	\$25,923	\$2,828	10.9%	\$28,751	0.0%	\$25,923	\$2,828	\$28,751	2029Q1	34.4%	\$34,832	\$3,800	\$38,632
0.5%	Planning During Construction	\$12,962	\$1,414	10.9%	\$14,375	0.0%	\$12,962	\$1,414	\$14,375	2029Q1	34.4%	\$17,416	\$1,900	\$19,316
0.5%	Adaptive Management & Monitoring	\$12,962	\$1,414	10.9%	\$14,375	0.0%	\$12,962	\$1,414	\$14,375	2025Q1	16.0%	\$15,035	\$1,640	\$16,675
0.5%	Project Operations	\$12,962	\$1,414	10.9%	\$14,375	0.0%	\$12,962	\$1,414	\$14,375	2025Q1	16.0%	\$15,035	\$1,640	\$16,675
31	CONSTRUCTION MANAGEMENT													
2.5%	Construction Management	\$64,808	\$7,270	11.2%	\$72,078	0.0%	\$64,808	\$7,270	\$72,078	2029Q1	34.4%	\$87,080	\$9,768	\$96,849
0.5%	Project Operation:	\$12,962	\$1,454	11.2%	\$14,416	0.0%	\$12,962	\$1,454	\$14,416	2029Q1	34.4%	\$17,416	\$1,954	\$19,370
0.8%	Project Management	\$19,442	\$2,181	11.2%	\$21,623	0.0%	\$19,442	\$2,181	\$21,623	2029Q1	34.4%	\$26,124	\$2,931	\$29,055
	CONTRACT COST TOTALS:	\$2,962,213	\$847,776		\$3,809,989		\$2,962,213	\$847,776	\$3,809,989			\$3,783,936	\$1,086,022	\$4,869,958

5.2. Total Project Cost Summary: Sea to EPAMT & PJPAMT Pathways (Authorized to -55FT, MLLW)

PROJECT: HDCI Feas. Study TSP: Sea to Port Elizabeth & Port Jersey (54FT Authorized Depth)
PROJECT NO: 472473
LOCATION: NY/NJ Harbor

DISTRICT: NAN
POC: ACTING CHIEF, COST ENGINEERING, Cynthia Zhang
PREPARED: 10/22/2020

This Estimate reflects the scope and schedule in report; Feasibility Study

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)					TOTAL PROJECT COST (FULLY FUNDED)				
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST (\$K) C	CNTG (\$K) D	CNTG (%) E	TOTAL (\$K) F	Program Year (Budget EC): Effective Price Level Date: 2021 1 OCT 20				Spent Thru: 1-Oct-20 (\$K) K	TOTAL FIRST COST (\$K) K	INFLATED (%) L	COST (\$K) M	CNTG (\$K) N	FULL (\$K) O
						ESC (%) G	COST (\$K) H	CNTG (\$K) I	TOTAL (\$K) J						
02	RELOCATIONS	\$242,000	\$85,710	35.4%	\$327,710	0.0%	\$242,000	\$85,710	\$327,710	\$0	\$327,710	19.7%	\$289,581	\$102,562	\$392,143
06	FISH & WILDLIFE FACILITIES	\$14,700	\$1,674	11.4%	\$16,374	0.0%	\$14,700	\$1,674	\$16,374	\$0	\$16,374	19.7%	\$17,590	\$2,003	\$19,593
12	NAVIGATION PORTS & HARBORS	\$2,500,959	\$766,656	30.7%	\$3,267,615	0.0%	\$2,500,959	\$766,656	\$3,267,615	\$0	\$3,267,615	29.4%	\$3,236,946	\$992,269	\$4,229,215
18	CULTURAL RESOURCE PRESERVATION	\$2,820	\$242	8.6%	\$3,062	0.0%	\$2,820	\$242	\$3,062	\$0	\$3,062	19.7%	\$3,374	\$289	\$3,663
CONSTRUCTION ESTIMATE TOTALS:		\$2,760,479	\$854,282		\$3,614,761	0.0%	\$2,760,479	\$854,282	\$3,614,761	\$0	\$3,614,761	28.5%	\$3,547,492	\$1,097,123	\$4,644,615
01	LANDS AND DAMAGES	\$851	\$170	20.0%	\$1,021	0.0%	\$851	\$170	\$1,021	\$0	\$1,021	15.4%	\$982	\$196	\$1,179
30	PLANNING, ENGINEERING & DESIGN	\$289,850	\$31,579	10.9%	\$321,429	0.0%	\$289,850	\$31,579	\$321,429	\$0	\$321,429	18.6%	\$343,822	\$37,459	\$381,281
31	CONSTRUCTION MANAGEMENT	\$103,518	\$11,597	11.2%	\$115,115	0.0%	\$103,518	\$11,597	\$115,115	\$0	\$115,115	34.4%	\$139,094	\$15,583	\$154,677
PROJECT COST TOTALS:		\$3,154,698	\$897,628	28.5%	\$4,052,326		\$3,154,698	\$897,628	\$4,052,326	\$0	\$4,052,326	27.9%	\$4,031,391	\$1,150,361	\$5,181,752

ACTING CHIEF, COST ENGINEERING, Cynthia Zhang

ESTIMATED TOTAL PROJECT COST: \$5,181,752

PROJECT MANAGER, Mark Lulka

CHIEF, REAL ESTATE, Lydia Willian

CHIEF, PLANNING, Cliff Jones

CHIEF, ENGINEERING, Michael Rovi

CHIEF, OPERATIONS, Thomas Creamer

CHIEF, CONSTRUCTION, Matthew Ludwig

CHIEF, CONTRACTING, Francis Cashman

CHIEF, DPM, Joseph Seebode

**** CONTRACT COST SUMMARY ****

PROJECT: HDCI Feas. Study TSP: Sea to Port Elizabeth & Port Jersey (54FT Authorized Depth)
 LOCATION: NY/NJ Harbor
 This Estimate reflects the scope and schedule in report; Feasibility Study

DISTRICT: NAN
 POC: ACTING CHIEF, COST ENGINEERING, Cynthia Zhang
 PREPARED: 10/22/2020

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 20-Aug-20		Effective Price Level: 1-Oct-20		Program Year (Budget EC): 2021		Effective Price Level Date: 1 OCT 20						
WBS NUMBER	Civil Works Feature & Sub-Feature Description	RISK BASED				ESC (%)	COST (\$K)	CNTG (\$K)	TOTAL (\$K)	Mid-Point Date	INFLATED (%)	COST (\$K)	CNTG (\$K)	FULL (\$K)
		COST (\$K)	CNTG (\$K)	CNTG (%)	TOTAL (\$K)									
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
PHASE 1 or CONTRACT 1														
02	RELOCATIONS	\$242,000	\$85,710	35.4%	\$327,710	0.0%	\$242,000	\$85,710	\$327,710	2027Q2	19.7%	\$289,581	\$102,562	\$392,143
06	FISH & WILDLIFE FACILITIES	\$14,700	\$1,674	11.4%	\$16,374	0.0%	\$14,700	\$1,674	\$16,374	2027Q2	19.7%	\$17,590	\$2,003	\$19,593
12	NAVIGATION PORTS & HARBORS	\$2,500,959	\$766,656	30.8%	\$3,267,615	0.0%	\$2,500,959	\$766,656	\$3,267,615	2030Q1	29.4%	\$3,236,946	\$992,269	\$4,229,215
18	CULTURAL RESOURCE PRESERVATION	\$2,820	\$242	8.6%	\$3,062	0.0%	\$2,820	\$242	\$3,062	2027Q2	19.7%	\$3,374	\$289	\$3,663
CONSTRUCTION ESTIMATE TOTALS:		\$2,760,479	\$854,282	30.9%	\$3,614,761		\$2,760,479	\$854,282	\$3,614,761			\$3,547,492	\$1,097,123	\$4,644,615
01	LANDS AND DAMAGES	\$851	\$170	20.0%	\$1,021	0.0%	\$851	\$170	\$1,021	2026Q1	15.4%	\$982	\$196	\$1,179
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	\$27,604.79	\$3,008	10.9%	\$30,612	0.0%	\$27,605	\$3,008	\$30,612	2025Q1	16.0%	\$32,020	\$3,489	\$35,509
0.5%	Planning & Environmental Compliance	\$13,802	\$1,504	10.9%	\$15,306	0.0%	\$13,802	\$1,504	\$15,306	2025Q1	16.0%	\$16,010	\$1,744	\$17,755
5.0%	Engineering & Design	\$138,024	\$15,038	10.9%	\$153,062	0.0%	\$138,024	\$15,038	\$153,062	2025Q1	16.0%	\$160,102	\$17,443	\$177,546
0.5%	Reviews, ATRs, IEPRs, VE	\$13,802	\$1,504	10.9%	\$15,306	0.0%	\$13,802	\$1,504	\$15,306	2025Q1	16.0%	\$16,010	\$1,744	\$17,755
0.5%	Life Cycle Updates (cost, schedule, risks)	\$13,802	\$1,504	10.9%	\$15,306	0.0%	\$13,802	\$1,504	\$15,306	2025Q1	16.0%	\$16,010	\$1,744	\$17,755
0.5%	Contracting & Reprographics	\$13,802	\$1,504	10.9%	\$15,306	0.0%	\$13,802	\$1,504	\$15,306	2025Q1	16.0%	\$16,010	\$1,744	\$17,755
1.0%	Engineering During Construction	\$27,605	\$3,008	10.9%	\$30,612	0.0%	\$27,605	\$3,008	\$30,612	2029Q1	34.4%	\$37,092	\$4,041	\$41,133
0.5%	Planning During Construction	\$13,802	\$1,504	10.9%	\$15,306	0.0%	\$13,802	\$1,504	\$15,306	2029Q1	34.4%	\$18,546	\$2,021	\$20,566
0.5%	Adaptive Management & Monitoring	\$13,802	\$1,504	10.9%	\$15,306	0.0%	\$13,802	\$1,504	\$15,306	2025Q1	16.0%	\$16,010	\$1,744	\$17,755
0.5%	Project Operations	\$13,802	\$1,504	10.9%	\$15,306	0.0%	\$13,802	\$1,504	\$15,306	2025Q1	16.0%	\$16,010	\$1,744	\$17,755
31	CONSTRUCTION MANAGEMENT													
2.5%	Construction Management	\$69,012	\$7,731	11.2%	\$76,743	0.0%	\$69,012	\$7,731	\$76,743	2029Q1	34.4%	\$92,730	\$10,388	\$103,118
0.5%	Project Operation:	\$13,802	\$1,546	11.2%	\$15,349	0.0%	\$13,802	\$1,546	\$15,349	2029Q1	34.4%	\$18,546	\$2,078	\$20,624
0.8%	Project Management	\$20,704	\$2,319	11.2%	\$23,023	0.0%	\$20,704	\$2,319	\$23,023	2029Q1	34.4%	\$27,819	\$3,117	\$30,935
CONTRACT COST TOTALS:		\$3,154,698	\$897,628		\$4,052,326		\$3,154,698	\$897,628	\$4,052,326			\$4,031,391	\$1,150,361	\$5,181,752

6. Abbreviated Risk Analysis Tables

6.1. ARA Summary 54FT Alternative

Abbreviated Risk Analysis

Project Name & Location: **NY and NJ Harbor Deepening Channel (54FT Channel)**
 Project Development Stage/Alternative: **Feasibility (Recommended Plan)**
 Risk Category: **Moderate Risk: Typical Project Construction Type**

District: **NAN**
 Alternative:
 Meeting Date: **5/12/2020**

Total Estimated Construction Contract Cost = **\$ 2,592,306,000**

CWWBS	Feature of Work	Contract Cost	% Contingency	\$ Contingency	Total
01 LANDS AND DAMAGES	Real Estate	\$ 503,000	20.0%	\$ 101,000.00	\$ 604,000
02 RELOCATIONS	Utility Relocations	\$ 242,000,000	35.4%	\$ 85,710,000.00	\$ 327,710,000
06 FISH AND WILDLIFE FACILITIES	Environmental Mitigation	\$ 14,400,000	11.4%	\$ 1,639,000.00	\$ 16,039,000
12 NAVIGATION, PORTS AND HARBORS	Drilling, Blasting, Demolition and Dredging	\$ 2,333,086,000	30.8%	\$ 719,489,000.00	\$ 3,052,575,000
18 CULTURAL RESOURCE PRESERVATION	Archaeological Mitigation	\$ 2,820,000	8.6%	\$ 242,000.00	\$ 3,062,000
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 272,192,000	10.9%	\$ 29,691,000.00	\$ 301,883,000
31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 97,211,000	11.2%	\$ 10,905,000.00	\$ 108,116,000

Totals					
	Real Estate	\$ 503,000	20%	\$ 101,000	\$ 604,000
	Total Construction Estimate	\$ 2,592,306,000	31%	\$ 807,080,000	\$ 3,399,386,000
	Total Planning, Engineering & Design	\$ 272,192,000	11%	\$ 29,691,000	\$ 301,883,000
	Total Construction Management	\$ 97,211,000	11%	\$ 10,905,000	\$ 108,116,000
	Total	\$ 2,962,212,000	29%	\$ 847,777,000	\$ 3,809,989,000

	Base	50%	80%
Range Estimate (\$000's)	\$2,962,212k	\$3,470,878k	\$3,809,989k

* 50% based on base is at 50% CL.

6.2. ARA Summary 55FT Alternative

Abbreviated Risk Analysis

Project Name & Location: **NY and NJ Harbor Deepening Channel (55FT Channel)**
 Project Development Stage/Alternative: **Feasibility (Recommended Plan)**
 Risk Category: **Moderate Risk: Typical Project Construction Type**

District: **NAN**
 Alternative:
 Meeting Date: **5/12/2020**

Total Estimated Construction Contract Cost = **\$ 2,760,479,000**

<u>CWWBS</u>	<u>Feature of Work</u>	<u>Contract Cost</u>	<u>% Contingency</u>	<u>\$ Contingency</u>	<u>Total</u>
01 LANDS AND DAMAGES	Real Estate	\$ 851,000	20.0%	\$ 170,000.00	\$ 1,021,000
02 RELOCATIONS	Utility Relocations	\$ 242,000,000	35.4%	\$ 85,710,000.00	\$ 327,710,000
06 FISH AND WILDLIFE FACILITIES	Environmental Mitigation	\$ 14,700,000	11.4%	\$ 1,674,000.00	\$ 16,374,000
12 NAVIGATION, PORTS AND HARBORS	Drilling, Blasting, Demolition and Dredging	\$ 2,500,959,000	30.8%	\$ 766,656,000.00	\$ 3,267,615,000
18 CULTURAL RESOURCE PRESERVATION	Archaeological Mitigation	\$ 2,820,000	8.6%	\$ 242,000.00	\$ 3,062,000
30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	\$ 289,850,000	10.9%	\$ 31,579,000.00	\$ 321,429,000
31 CONSTRUCTION MANAGEMENT	Construction Management	\$ 103,518,000	11.2%	\$ 11,597,000.00	\$ 115,115,000

Totals					
	Real Estate	\$ 851,000	20%	\$ 170,000	\$ 1,021,000
	Total Construction Estimate	\$ 2,760,479,000	31%	\$ 854,282,000	\$ 3,614,761,000
	Total Planning, Engineering & Design	\$ 289,850,000	11%	\$ 31,579,000	\$ 321,429,000
	Total Construction Management	\$ 103,518,000	11%	\$ 11,597,000	\$ 115,115,000
	Total	\$ 3,154,698,000	28%	\$ 897,628,000	\$ 4,052,326,000

	Base	50%	80%
Range Estimate (\$000's)	\$3,154,698k	\$3,693,275k	\$4,052,326k

* 50% based on base is at 50% CL.

6.3. ARA Risk Registry

All identified risks are covered in this ARA Risk Registry. Any Construction Accounts not discussed within a given Risk Category were identified to have negligible associated risks.

NY and NJ Harbor Deepening Channel (54FT Channel)

Feasibility (Recommended Plan)
 Abbreviated Risk Analysis

Meeting Date: 5/11/20

	Risk Level				
Very Likely	2	3	4	5	5
Likely	1	2	3	4	5
Possible	0	1	2	3	4
Unlikely	0	0	1	2	3
	Negligible	Marginal	Moderate	Significant	Critical

Risk Register

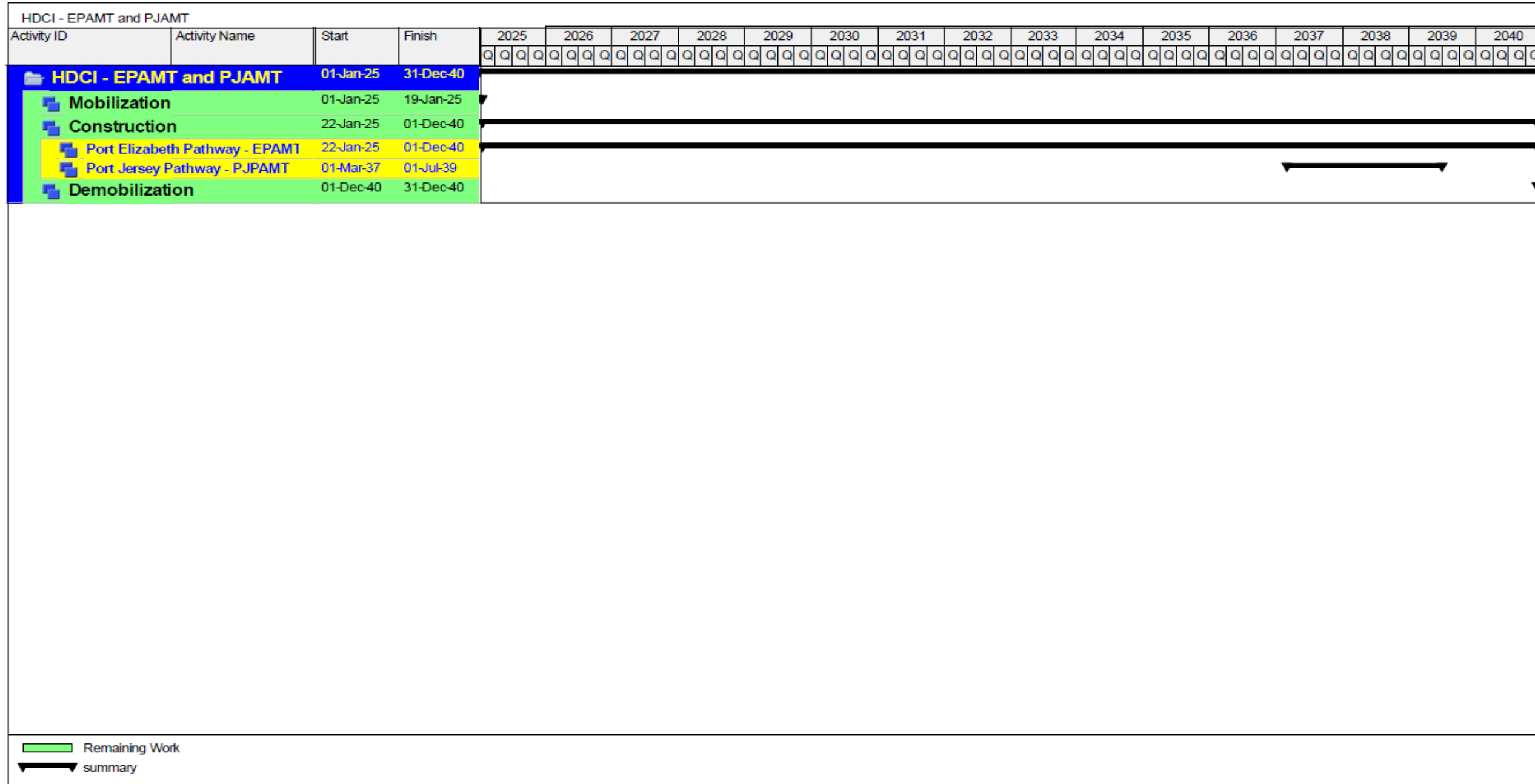
Use/View	Risk Element	Feature of Work	Concerns	PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact)	Impact	Likelihood	Risk Level
-	Project Scope Growth			Maximum Project Growth		60%	
Yes	PS-1	Project Scope Risks to Navigation Costs	The study partners, Port Authority of NY/NJ (PANYNJ) and the Harbor Pilots might revise their preferences with respect to designed widening and straightening's on the basis of new information or circumstances.	IMPACT: If realized, such a risk corresponds with Moderate impacts in the Ambrose, Anchorage and Port Jersey channels. LIKELIHOOD: For all channels, realization of this risk is assessed by the PDT as Possible.	Moderate	Possible	2
Yes	PS-2	Project Scope Risks to Navigation Costs	The study partners, Port Authority of NY/NJ (PANYNJ) and the Harbor Pilots might revise their preferences with respect to designed widening and straightening's on the basis of new information or circumstances.	IMPACT: If realized, such a risk corresponds with Significant impacts in the remaining Kill Van Kull, Newark Bay, South Elizabeth, Port Elizabeth and Arthur Kill channels. LIKELIHOOD: For all channels, realization of this risk is assessed by the PDT as Possible.	Significant	Possible	3
Yes	PS-3	Project Scope Risks to Relocation	The current inventory of utilities may not be complete.	IMPACT: If realized, such a risk corresponds with Critical impact to the estimated cost of utility relocations. LIKELIHOOD: For all channels, the likelihood is assessed as Possible.	Critical	Possible	4
-	Acquisition Strategy			Maximum Project Growth		40%	
Yes	AS-3	Acquisition Risks to Navigation Costs	The dredging industry might not provide sufficient competition over advertised contracts.	IMPACT: If realized, such a risk corresponds with Marginal impacts in the Ambrose, Anchorage and Port Jersey channels. LIKELIHOOD: For the reaches where blasting may be required, realization of this risk is assessed by the PDT as Likely because blasting services will likely be required in these channels and the fleet of equipment for offshore blasting services is far more limited than that of dredging services in general.	Marginal	Likely	2
Yes	AS-4	Acquisition Risks to Navigation Costs	The dredging industry might not provide sufficient competition over advertised contracts.	IMPACT: If realized, such a risk corresponds with Moderate impacts in the remaining Kill Van Kull, Newark Bay, South Elizabeth, Port Elizabeth and Arthur Kill channels. LIKELIHOOD: For the remaining channels, the risk is assessed as Possible.	Moderate	Possible	2
-	Construction Elements			Maximum Project Growth		30%	
Yes	CON-1	Construction Environmental Mitigation Costs	It is either the in-kind environmental mitigation assumption will not be deemed acceptable upon further environmental investigation or that the estimated air quality mitigation requirements turn out to be insufficient. Applies equally to all channels.	IMPACT: If realized, such risks correspond with Marginal impacts across all channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Unlikely.	Marginal	Unlikely	0

Yes	CON-2	Construction Risks to Navigation Costs	It is assumed the application of drilling and blasting contained within this study (see Drilling & Blasting section) has under-estimated the actual need for such material pre-treatment. This concern captures risks associated with assumed drilling concentrations, assumed volumes of residually fractured rock from previous phase of deepening and assumed production rates.	IMPACT: If realized, such a risk corresponds with Moderate impacts in the reaches where blasting may be required: Kill Van Kull, Newark Bay, South Elizabeth, Port Elizabeth and Arthur Kill channels and the Ambrose Mound. LIKELIHOOD: For the Kill Van Kull, Arthur Kill and the Ambrose Mound reaches, the likelihood is assessed as Possible.	Moderate	Possible	2
Yes	CON-3	Construction Risks to Navigation Costs	It is assumed the application of drilling and blasting contained within this study (see Drilling & Blasting section) has under-estimated the actual need for such material pre-treatment. This concern captures risks associated with assumed drilling concentrations, assumed volumes of residually fractured rock from previous phase of deepening and assumed production rates.	IMPACT: If realized, such a risk corresponds with Moderate impacts in the reaches where blasting may be required: Newark Bay, South Elizabeth, Port Elizabeth and Arthur Kill channels and the Ambrose Mound. LIKELIHOOD: For the remaining Newark Bay, South Elizabeth and Port Elizabeth channels, the likelihood is assessed as Unlikely.	Moderate	Unlikely	1
Yes	CON-4	Construction Risks to Cultural Mitigation Costs	Upon further investigation, more cultural resources to be mitigated are identified.	IMPACT: If realized, such a risk corresponds with Moderate impacts in all channels. LIKELIHOOD: For the Ambrose channel, the likelihood of realization of this risk is Unlikely.	Moderate	Unlikely	1
Yes	CON-5	Construction Risks to Cultural Mitigation Costs	Upon further investigation, more cultural resources to be mitigated are identified.	IMPACT: If realized, such a risk corresponds with Moderate impacts in all channels. LIKELIHOOD: For all other channels the likelihood determined by the PDT is Possible.	Moderate	Possible	2
Yes	CON-6	Construction Risks to Construction Management Costs	Vibrations from blasting might result in damage to nearby structures	IMPACT: If realized, such a risk corresponds with Critical impacts in Arthur Kill and Kill Van Kull channels. LIKELIHOOD: For the potentially impacted channels, the likelihood is assessed as Unlikely.	Critical	Unlikely	3
Yes	CON-7	Construction Risks to Construction Management Costs	Vibrations from blasting might result in damage to nearby structures	IMPACT: If realized, such a risk corresponds with Significant impacts in the South Elizabeth and Port Elizabeth channels. LIKELIHOOD: For the potentially impacted channels, the likelihood is assessed as Unlikely.	Significant	Unlikely	2
Yes	CON-8	Construction Risk to Relocations	Estimated methods and costs may be under-estimated based on limited available information.	IMPACT: If realized, such a risk corresponds with Critical impact to the estimated cost of utility relocations. LIKELIHOOD: For all channels, the likelihood is assessed as Possible.	Critical	Possible	4
Yes	CON-9	Construction Risk to Navigation.	Unstable slopes may require additional dredging or bulkhead construction that is not currently part of the estimated design	IMPACT: If realized, such a risk corresponds with in to MODERATE likelihood and impact for the effected channels: Port Jersey, KVK, Newark Bay South and Newark Bay North. LIKELIHOOD: If realized, such a risk corresponds with in increased likelihood to POSSIBLE and impact for the effected channels: Port Jersey, KVK, Newark Bay South and Newark Bay North.	Moderate	Possible	2
-	Quantities for Current Scope					Maximum Project Growth	20%

Yes	Q-1	Quantities risks to Environmental Mitigation Costs	New information or changes in regulations might result in a greater number of habitats requiring mitigation than currently estimated.	IMPACT: If realized, such risks correspond with Significant impacts in the Kill Van Kull and Newark Bay channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Possible in the Newark Bay South, Port Jersey and Kill Van Kull channels.	Significant	Possible	3
Yes	Q-2	Quantities Risks to Environmental Mitigation Costs	New information or changes in regulations might result in a greater number of habitats requiring mitigation than currently estimated.	IMPACT: If realized, such risks correspond with Moderate impacts in all other channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Unlikely in all other channels.	Moderate	Unlikely	1
Yes	Q-3	Quantities Risks to Navigation Costs	Quantities associated with dredging or blasting or the assignment of low production cautious blasting might be under-estimated due to incomplete/preliminary geotechnical information, structures survey or ship modelling.	IMPACT: If realized, such risks correspond with Significant impacts in the Ambrose, Kill Van Kull and Arthur Kill channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Very Likely in the Newark Bay South, Likely in Arthur Kill and Newark Bay Center and Newark Bay North reaches.	Significant	Very LIKELY	5
Yes	Q-4	Quantities Risks to Navigation Costs	Quantities associated with dredging or blasting or the assignment of low production cautious blasting might be under-estimated due to incomplete/preliminary geotechnical information, structures survey or ship modelling.	IMPACT: If realized, such risks correspond with Marginal in South Elizabeth and Port Elizabeth channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Possible in Ambrose, Port Elizabeth and Kill Van Kull channels and Unlikely in South Elizabeth, Port Jersey and Anchorages channels.	Marginal	Possible	1
Yes	Q-5	Quantities Risks to Cultural Mitigation Costs	The vibration monitoring plan, employing five sites at all times to be moved as blasting locations change, will not be sufficient for capturing all the vibration impacts of the blasting.	IMPACT: If realized, such risks correspond with Marginal impacts in all channels that require drilling and blasting operations. LIKELIHOOD: Realization of these risks is assessed by the PDT as Possible for all channels that require drilling and blasting operations.	Marginal	Possible	1
-	Specialty Fabrication or Equipment				Maximum Project Growth		75%
Yes	FE-1	Equipment risks to Relocations Costs	Incomplete utility relocation or structure removal design may result in higher costs than estimated.	IMPACT: If realized, such risks correspond with Significant impacts in the South Anchorage channel, Moderate impacts in the Arthur Kill channel. LIKELIHOOD: Realization of these risks is assessed by the PDT as Possible in the South Anchorage and Arthur Kill channels.	Moderate	Possible	2
Yes	FE-2	Equipment risks to Relocations Costs	Incomplete utility relocation or structure removal design may result in higher costs than estimated.	IMPACT: If realized, such risks correspond with Marginal impacts in the North Anchorage channel. LIKELIHOOD: Realization of these risks is assessed by the PDT as Unlikely in the North Anchorage channel.	Marginal	Unlikely	0
Yes	FE-3	Equipment risks to Navigation Costs	Heavier duty or different specialty equipment might be required for dredging or blasting throughout the project work area or specialty demolition services such as at sites of abandoned bridges.	IMPACT: If realized, such risks correspond with Significant impacts in the Port Jersey and Anchorage channels, Moderate impacts in the Ambrose, Kill Van Kull, Newark Bay Center and North, South Elizabeth and Port Elizabeth channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Very Likely in the Arthur Kill and Newark Bay South reaches, Possible in the Kill Van Kull, Port Jersey, Anchorage and Ambrose reaches (particularly at the location of the "mound").	Significant	Very LIKELY	5

Yes	FE-4	Equipment risks to Navigation Costs	Heavier duty or different specialty equipment might be required for dredging or blasting throughout the project work area or specialty demolition services such as at sites of abandoned bridges.	IMPACT: If realized, such risks correspond with Negligible impacts in the Arthur Kill channel and Newark Bay South reaches. LIKELIHOOD: Realization of these risks is assessed by the PDT as Unlikely at the South Elizabeth, Port Elizabeth, and Newark Bay (Center and North) reaches.	Negligible	Unlikely	0
-	Cost Estimate Assumptions					Maximum Project Growth	35%
Yes	EST-1	Cost Estimating Risks to Environmental Mitigation Costs	Anticipated environmental mitigation costs might be greater once estimated with higher resolution (they are currently estimated parametrically).	IMPACT: If realized, such risks correspond with Moderate impacts in all channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Likely for all channels.	Moderate	Likely	3
Yes	EST-2	Cost Estimating Risks to Navigation Costs	The production assumption for all reaches containing multiple categories of rock hardness should all be estimated assuming the most competent rock for the full volume is an insufficiently conservative assumption.	IMPACT: If realized, such risks correspond with Moderate impacts for the Ambrose, KVK, Newark Bay, South Elizabeth and Arthur Kill Channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Possible for the Ambrose, KVK, Newark Bay, South Elizabeth and Arthur Kill Channels.	Moderate	Possible	2
Yes	EST-3	Cost Estimating Risks to Cultural Mitigation Costs	Cultural mitigation costs might grow at a rate greater than anticipated over the next ten years.	IMPACT: If realized, such risks correspond with Moderate impacts for all channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Possible for all channels.	Moderate	Possible	2
Yes	EST-4	Cost Estimating Risks to PED Costs	The greater complexity associated with some channels is not fully captured in the estimated costs for PED and S&A.	IMPACT: If realized, such risks correspond with Significant impacts in the Newark Bay South channel, Moderate impacts in the Kill Van Kull, Newark Bay Center and North channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Likely in the Arthur Kill and KVK channel and Newark Bay South and North reaches.	Significant	Likely	4
Yes	EST-5	Cost Estimating Risks to PED Costs	The greater complexity associated with some channels is not fully captured in the estimated costs for PED and S&A.	IMPACT: If realized, such risks correspond with Marginal impacts in the Arthur Kill, Port Elizabeth and South Elizabeth channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Unlikely at the South Elizabeth and Port Elizabeth channels.	Marginal	Unlikely	0
-	External Project Risks					Maximum Project Growth	40%
Yes	EX-1	External Risks to PED and S&A Costs	The proximity of dredging and blasting operations to dense population centers could give rise to greater than anticipated vibration, noise and air quality concerns and that these concerns might drive up PED and S&A costs.	IMPACT: If realized, such risks correspond with Moderate impacts in the KVK and Arthur Kill channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Likely in the Arthur Kill and KVK channels.	Moderate	Likely	3
Yes	EX-2	External Risks to PED and S&A Costs	The proximity of dredging and blasting operations to dense population centers could give rise to greater than anticipated vibration, noise and air quality concerns and that these concerns might drive up PED and S&A costs.	IMPACT: If realized, such risks correspond with Marginal impacts in the Port Elizabeth and South Elizabeth channels and Negligible impacts in all other channels. LIKELIHOOD: Realization of these risks is assessed by the PDT as Possible in all other channels except Arthur Kill and KVK channels.	Marginal	Possible	1

7.2. Figure 2: Construction Schedule for 55FT Alternative (16 Years)



8. MII

The Construction Costs for all Construction Accounts included in this estimate are shown on the next page.

<u>Description</u>	<u>Quantity</u>	<u>UOM</u>	<u>ProjectCost</u>
HDCI All Construction WBS Accounts			5,352,785,000
54FT Alternative	1	LS	2,592,306,000
Account 02 Relocations	1	LS	242,000,000
Account 06 Fish & Wildlife Facilities	1	LS	14,400,000
Account 12 Navigation Ports & Harbors	1	LS	2,333,086,000
Account 18 Cultural Resource Preservation	1	LS	2,820,000
55FT Alternative	1	LS	2,760,479,000
Account 02 Relocations	1	LS	242,000,000
Account 06 Fish & Wildlife Facilities	1	LS	14,700,000
Account 12 Navigation Ports & Harbors	1	LS	2,500,959,000
Account 18 Cultural Resource Preservation	1	LS	2,820,000